A critical appraisal of "Constraint- induced movement therapy (CIMT) for young children with cerebral palsy: Effects of therapeutic dosage"

By

Natalie Rhames, SPT

In partial fulfillment of the

requirements for the course:

PT 7240 Evidence-Based Practice in Physical Therapy

Department of Physical Therapy

Angelo State University

Member, Texas Tech University System

October 24, 2020

Abstract

The purpose of this study was to determine an effective dosage for constraint-induced movement therapy (CIMT) in pediatric patients with hemiplegic cerebral palsy (CP). This objective was achieved by randomly assigning subjects to either the high-dosage treatment group (6 hours/day) or the moderate-dosage treatment group (3 hours/day). The hypothesized outcome was that subjects in the high-dosage group would see greater improvements in functional upper arm movements following the 21 days of CIMT, including long-arm casting. Participants were assigned to one of three research sites where they underwent their therapy and were evaluated on baseline and progress via outcome measures 1- week prior, and 1-week and 1-month following treatment. The selected outcome measures were the Assisting Hand Assessment (AHA), the Quality of Upper Extremity Skills Test (QUEST), the Shriners Hospital Upper Extremity Evaluation (SHUEE) and the Pediatric Motor Activity Log (PMAL). Blinded physical and occupational therapists performed the evaluations while therapist involved in the treatment interventions had pediatric experience and underwent a training in the CIMT protocol used. There were 18 total participants, there was no subject attrition, and all participants completed all aspects of the treatment plan.

The study found that both dosage groups demonstrated significant improvements on each outcome measure however, there were no significant differences dependent on dosage group. It was concluded that both high-dosage and moderate-dosage CIMT for treatment of pediatric patients with hemiplegic cerebral palsy were effective for improvements in functional upper arm movements. These results were not in concordance with the hypothesis but are clinically relevant. The authors suggested that future studies strive to evaluate the effects of alternative

CIMT administration methods, more individualized CIMT programs and varied casting approaches including duration and technique.

Key words

Constraint-induced movement therapy (CIMT), pediatric, cerebral palsy, dosage

Introduction

Constraint-induced movement therapy (CIMT) is a therapy form meant to improve functional abilities of the upper extremities with emphasis on forced use of the affected limb. This therapy type is frequently used for patients who have suffered from central nervous system (CNS) injury. Improved use of the affected limb is usually accomplished by restraint of the non-affected limb. I became acquainted with CIMT as a potential treatment for cerebral palsy (CP) during my observational experiences at a pediatric clinic. At the time I observed this treatment I was unaware of the technique but was fascinated by the progress in functionality that the child was making. Following formal introduction to CIMT in motor control I was curious to further assess the effectiveness of CIMT as a treatment option. The research question backing this clinical appraisal reads: Is constraint- induced movement therapy (CIMT) an effective treatment option for improving the functional independence of pediatric patients with Cerebral Palsy?

Methods

The literature search began in PubMed. Two articles pertaining to the research question were found, however the PubMed search became limited due to availability of full text articles. The search continued using the ASU Academic Search Complete database and one additional article was found. The keywords used in the search were CIMT, pediatric and cerebral palsy. The

PubMed database search was filtered by “Randomized controlled trial” and “clinical trial.” Though these filters limited the search, it was appropriate to guarantee meeting the criteria for the assignment. The ASU Academic Search Complete database search was filtered by “full text” given repeated encounters with abstracts requiring purchase for the complete text. The inclusions criteria for this search were population and interventions. The population inclusions were pediatric patients with CP, while intervention criteria was the use of CIMT. Using the keywords in the PubMed database, the total number of hits was 42 articles. This is a significant number given the rather specific search, however many of these hits were either systematic reviews or full text articles for purchase.

The article for critical appraisal was published in 2012 in the *Journal of Pediatric Rehabilitation Medicine: An Interdisciplinary Approach*. The corresponding author, Stephanie DeLuca, appeared several times in the initial search for research articles on CIMT in pediatric populations with CP. This was a multisite study that took place at the Ohio State University, the University of Virginia, the University of Alabama at Birmingham, and randomization of participants occurred at Georgetown University. Despite a small sample size of participants, the study involved random allocation of participants to groups and masked therapists to the patients’ group status. Therapists were monitored for treatment fidelity and were required to fill out a daily log of activities. All participants had a similar clinical background in that their unilateral CP was a result of CNS lesion before the age of one month and had never received CIMT. There was no participant attrition. Lastly, the selected methods of upper extremity assessment of functionality (AHA, SHUEE, QUEST) were evaluated for reliability and exhibited high intra-rater reliability. This article was selected following appraisal and determination of solid clinical credibility.

Results

Summary of the study

Constraint- Induced Movement Therapy (CIMT) is a therapeutic technique emphasizing daily high intensity and long duration therapy with constraint of the non-affected limb to promote increased functionality in the affected limb. This randomized controlled trial (RCT) strove to compare the effectiveness of varying dosage CIMT for pediatric patients with cerebral palsy (CP). Eighteen children between the ages of 3 and 6, all with unilateral CP, were randomly assigned to either the high dosage (6 hours/day) or the moderate dosage (3 hours/day) groups. All participants had their non-affected arms casted for the duration of the 21-day study and underwent a series of baseline testing of upper extremity functionality (AHA, SHUEE, QUEST), including a parental assessment of abilities (PMAL). The study found there were no significant differences in improvements between high and moderate dosage CIMT and that participants in both groups demonstrated improvements in upper extremity functionality following the treatment intervention.

Appraisal of the study introduction

The introduction was overall well written and informative. The authors presented a strong explanation of CIMT and used scientific literature to support the use of CIMT in young populations with CP. The intent of the study was justified by acknowledging the recommendations of prior scientific literature on the subject.

The only potential weakness of the introduction would be the inclusion of older works in the literature review. The literature published earlier than 20 years ago (reference 20 and 21) was the initial manual published for QUEST (an outcome measure) and an assessment of its reliability. Reference 10 was published over 30 years ago but served to provide historical context of CIMT developed for

rehabilitating stroke patients. While these sources cannot be considered current, they did serve the introduction in an effective manner.

Appraisal of the study methods

This study was a longitudinal and prospective RCT in which treatment assessors were blinded to patients' treatment group. The study adhered to inclusion and exclusion criteria as 92 children were assessed for eligibility and only 18 children between the ages of 3 and 6 with unilateral CP were recruited and participated. Subjects were randomly assigned to their treatment group following enrollment using the Data Coordinating and Analysis Center (DCAC) for randomization of group assignment. The two treatment groups did have similar clinical characteristics in that all participants shared a diagnosis of unilateral CP because of CNS lesions occurring prior to turning one month old. Treatments were consistent as all groups were managed the same except for the quantity of experimental intervention. Additionally, the therapists implementing the interventions adhered to the ACQUIRE CIMT protocol.

The intervention was described thoroughly and clearly except for specific exercises included in the ACQUIRE CIMT protocol. The process was detailed when discussing casting, location of interventions and therapist responses but was vague when discussing specific activities that the child was doing. Replicability of the specific activities would be difficult. Another weakness of this study is that it was not explicitly stated whether the therapists performing the interventions were blinded to the participant treatment group. Despite being carefully monitored for consistency and adherence to the protocol, this could prove to be bias in treatment implementation.

Appraisal of the study results

The study had no subject attrition and results were obtained using outcome measures that were assessed for inter- and intra-rater reliability. The results addressed the research question and disproved the hypothesis that a higher dosage of CIMT would produce significantly greater improvements in upper extremity functionality. The results were clinically meaningful because they demonstrated both high and moderate doses of CIMT as an effective treatment that promotes flexibility to accommodate the schedule of the patient and their family.

The figures and tables presented in the results section exhibited formatting issues and title inconsistencies when representing data from a single outcome measure (SHUEE). The axes in Figure 2 were covered by the data making legibility difficult. Additionally, the methods section acknowledges the conversion of raw data to Logit scores, but the meanings of Logit scores are not clear. Lastly, each of the figure names show the complete name of each outcome measure. Prior to this point, the outcome measures are only referred to as acronyms. This is confusing and the authors should have remained consistent with their use of the acronym or stated the full name of the test at some point prior to the results.

Appraisal of the study discussion

The authors did further indicate their findings and elaborate on the implications of their results. The results were tied back to the existing literature supporting CIMT as an effective treatment for CP by providing information on dosage. Limitations of the study were acknowledged, and suggestions were provided for future studies to determine the minimum threshold of improvement, use of larger sample sizes and investigation into specific characteristics in children and how these impact the benefits of CIMT.

Clinical significance of the study was not addressed. The authors did speculate that insufficient participant attention or 3 hours/day being the maximum benefit one can receive from

CIMT could be potential reasons for more CIMT not equating to greater rehabilitation benefits. While these speculations are relevant, they are not a discussion of clinical significance.

Discussion

This study provides an important consideration for PTs working with pediatric patients with CP. If improving functionality is a therapeutic goal, then CIMT should be a consideration for the plan of care. The results directly pertain to my research question and provide information regarding the dosage of CIMT. Considering both high and moderate dosage CIMT is beneficial in improving functionality, therapists have flexibility in designing therapy plans that best meet the availability and lifestyle of their patients.

The intervention selected for this method was effective and demonstrated clinically significant improvements in functional abilities of the upper extremities. The risks of CIMT and the involved casting were relatively low, and participants were evaluated for skin integrity weekly. Subjects exhibited no major discomforts with the casting and there was no subject attrition to suggest issues with the intervention. The potential benefits of increased functionality do outweigh the potential risks of using CIMT. Future studies should evaluate what the minimum amount of CIMT is to see similar benefits because at least 3 hours/day of therapy may not always be feasible.

The evidence supporting CIMT as an effective method in this article and previous literature is an important consideration for physical therapists. Confidence in this treatment can be attributed to the reliable outcome measures used to acquire these results and CIMT should be considered beneficial for improving upper extremity function in pediatric patients with CP.

Given the intensity of this treatment, effective outcomes in practice would require commitment from the therapist, the patient, and their family to maximize improvements and safety.

CIMT is established as an effective intervention for pediatric patients with CP and this study contributed to the field's knowledge by providing insight into effective dosage. While more research is needed to fine-tune CIMT dosage information, this study contributed momentum to the pursuit. Overall, the authors present a comprehensive case for the use of CIMT in pediatric patients with CP.